

The documentation and process conversion measures necessary to comply with this amendment shall be completed by 16 Jun 95.

[INCH-POUND]

MIL-S-19500/598
AMENDMENT 4
16 December 1994
SUPERSEDING
AMENDMENT 3
27 January 1993

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, QUAD, FIELD EFFECT TRANSISTOR,
P-CHANNEL AND N-CHANNEL, SILICON TYPE 2N7336
JANTX, JANTXV, AND JANS

This amendment forms a part of MIL-S-19500/598, dated 11 December 1991, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 7

4.5.2b., add "minimum" to end of sentence.

PAGE 12

* TABLE IIA, subgroup 5, Accelerated steady state reverse bias, conditions column, delete " V_{DS} = rated" and substitute " V_{DS} = 80 percent of rated".

PAGE 14

TABLE III, subgroup 2, inspection column, terminal strength test, delete "(tension)" and substitute "(fatigue)"; conditions column, delete "Test condition A: Weight = 10 pounds, t = 15 seconds." and substitute "Test condition E; The sampling plan applies to the number of leads tested. A minimum of three devices shall be tested."

PAGE 16

TABLE IV, subgroup 3, inspection column, delete "Destructive physical analysis (DPA)" and substitute "Not Applicable". In the qualification and large lot quality conformance inspection column, delete "3 devices $c = 0$ ".

The attached insertable replacement pages listed below are replacements for stipulated pages. When the new pages have been entered in the document, insert the amendment as the cover sheet to the specification.

Replacement page

5
6
9
10

Pages replaced

Reprinted without change
6
9
10

AMSC N/A

1 of 2

ISC 5961

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The margins of this amendment are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

CONCLUDING MATERIAL

Custodians:

Army - ER
Navy - EC
Air Force - 17
NASA - NA

Preparing activity:

DLA - ES

(Project 5961-1722-01)

Review activities:

Army - AR, MI, SM
Navy - AS, CG, MC
Air Force - 13, 19, 85, 99
DLA - ES

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2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Detail specification. The individual item requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-S-19500.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500, and figure 1 herein.

3.3.1 Lead formation material and finish. Lead finish shall be solderable in accordance with MIL-STD-750, MIL-S-19500, and herein. Where a choice of lead material or finish is desired, it shall be specified in the contract or purchase order (see 6.5).

3.4 Marking. Marking shall be in accordance with MIL-S-19500.

3.5 Electrostatic discharge protection. The devices covered by this specification require electrostatic protection.

3.5.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of electrostatic charge. The following handling practices shall be followed.

- a. Devices shall be handled on benches with conductive handling devices.
- b. Ground test equipment, tools, and personnel handling devices.
- c. Do not handle devices by the leads.
- d. Store devices in conductive foam or carriers.
- e. Avoid use of plastic, rubber, or silk in MOS areas.
- f. Maintain relative humidity above 50 percent if practical.
- g. Care shall be exercised, during test and troubleshooting, to apply not more than maximum rated voltage to any lead.
- h. Gate must be terminated to source, $R \leq 100 \text{ k}$, whenever bias voltage is to be applied drain to source.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-S-19500, and as specified herein. Alternate flow is allowed for qualification inspection in accordance with figure 2 of MIL-S-19500.

4.2.1 Group E inspection. Group E inspection shall be conducted in accordance with MIL-S-19500, and table IV herein.

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4.5.1 Screening (JANC). Screening shall be in accordance with MIL S-19500 (appendix H). As a minimum, die shall be 100 percent probed in accordance with group A.

Screen (see table II of MIL-S-19500)	Measurement	
	JANS Level	JANTX and JANTXV Levels
<u>1/</u> <u>2/</u>	Gate stress test (see 4.5.5)	Gate stress test (see 4.5.5)
<u>1/</u>	Method 3161 (see 4.5.3)	Method 3161 (see 4.5.3)
9 <u>1/</u>	I_{GSS1} , I_{DSS1} , subgroup 2 of table I herein	Subgroup 2 of table I herein
10	Method 1042, test condition B	Method 1042, test condition B
11	I_{GSS1} , I_{DSS1} , $r_{DS(on)1}$, $V_{GS(th)1}$ Subgroup 2 of table I herein; $\Delta I_{GSS1} = \pm 20 \text{ nA dc or } \pm 100 \text{ percent of initial value, whichever is greater}$ $\Delta I_{DSS1} = \pm 25 \mu\text{A dc or } \pm 100 \text{ percent of initial value, whichever is greater}$	I_{GSS1} , I_{DSS1} , $r_{DS(on)1}$, $V_{GS(th)1}$, subgroup 2 of table I herein
12	Method 1042, test condition A, $t = 240 \text{ hours}$	Method 1042, test condition A
13	Subgroups 2 and 3 of table I herein; $\Delta I_{GSS1} = \pm 20 \text{ nA dc or } \pm 100 \text{ percent of initial value, whichever is greater}$ $\Delta I_{DSS1} = \pm 25 \mu\text{A dc or } \pm 100 \text{ percent of initial value, whichever is greater}$ $\Delta r_{DS(on)1} = \pm 20 \text{ percent of initial value}$ $\Delta V_{GS(th)1} = \pm 20 \text{ percent of initial value}$	Subgroup 2 of table I herein; $\Delta I_{GSS1} = \pm 20 \text{ nA dc or } \pm 100 \text{ percent of initial value, whichever is greater}$ $\Delta I_{DSS1} = \pm 25 \mu\text{A dc or } \pm 100 \text{ percent of initial value, whichever is greater}$ $\Delta r_{DS(on)1} = \pm 20 \text{ percent of initial value}$ $\Delta V_{GS(th)1} = \pm 20 \text{ percent of initial value}$

1/ Shall be performed anytime before screen 10.

2/ This is a stress test designed to insure a rugged product.

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TABLE 1. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u> - Continued						
Static drain to source on-state resistance	3421	$V_{GS} = 10 \text{ V dc}$ Pulsed (see 4.5.1) $I_D = \text{rated } I_{D2}$	$r_{DS(on)3}$			Ω
N-channel					1.4	
P-channel					2.3	
Gate to source voltage (threshold)	3404	$V_{DS} \geq V_{GS}$, $I_D = 0.25 \text{ mA dc}$	$V_{GS(th)2}$	1.0		V dc
Low temperature operation:		$T_C = T_J = -55^\circ\text{C}$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, $I_D = 0.25 \text{ mA dc}$	$V_{GS(th)3}$		5.0	V dc
<u>Subgroup 4</u>						
Switching time test	3472	$I_D = \text{rated } I_{D1}$, $V_{GS} = 10 \text{ V dc}$, $R_g = 24\Omega$ $V_{DD} = 0.5 V_{BR(DSS)}$				
Turn-on delay time			$t_{d(on)}$			ns
N-channel					20	
P-channel					30	
Rise time			t_r			ns
N-channel					25	
P-channel					60	
Turn-off delay time			$t_{d(off)}$		40	ns
Fall time			t_f			ns
N-channel					40	
P-channel					60	

See footnote at end of table.

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TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 5</u>						
Single pulse avalanche energy	3470	See 4.5.4	E _{AS}			
Electrical measurements		See table V herein, steps 1, 2, 3, 4, 5, and 6				
Safe operating area test	3474	V _{DS} = 80 percent of rated V _{BR(DSS)} , t _p = 10 ms				
N-channel		I _D = 0.25 A			40	
P-channel		I _D = 0.05 A			60	
Electrical measurements		See table V herein, steps 1, 2, 3, 4, 5, 6, and 7				
<u>Subgroup 6</u>						
Not applicable						
<u>Subgroup 7</u>						
Gate charge	3471	Condition B				
On-state gate charge			Q _{g(on)}		15	nC
Gate to source charge			Q _{gs}			nC
N-channel					7.5	
P-channel					7.0	
Gate to drain charge			Q _{gd}			nC
N-channel					7.5	
P-channel					8.0	
Reverse recovery time	3473	di/dt = 100 A/μs V _{DD} ≤ 30 V dc I _D = I _{D1}	t _{rr}		200	ns

1/ For sampling plan, see MIL-S-19500.